



Huntington Power Plant

6 miles west of Huntington, Utah on Hwy. 31
P.O. Box 680
Huntington, Utah 84528

March 2, 2016

Mr. Bryce Bird, Director
Utah Department of Environmental Quality
Division of Air Quality
195 North 1950 West
P.O. Box 144820
Salt Lake City, UT 84114-4820

RE: **1st Quarter, 2016 Particulate Matter Compliance Test Report - 40 CFR 63 SubPart UUUUU,**
Huntington Power Plant (Title V Permit #1501001004)

Dear Mr. Bird,

In accordance with Title V Permit Conditions II.B.2.g.1(b) (Unit 1), II.B.3.f.1(b) (Unit 2), and 40 CFR §63.10021(d) the Huntington Power Plant submits this 1st Quarter 2016 Particulate Matter (PM) Compliance Test Report. 40 CFR §63.10031(f)(6) requires the submittal of compliance test results that were generated prior to April 16, 2017. This submittal is intended to satisfy the report submittal for Huntington Units 1 and 2, and includes the portable document format (PDF) report that is submitted electronically via the Emissions Collection and Monitoring Plan System (ECMPS).

The summary results of the 1st Quarter 2016 PM test results are:

Unit	Emission rate (lb/mmBtu)
1	0.005
2	0.005

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information, or omitting statements and information, including the possibility of fine or imprisonment.

Should you have any questions regarding this information, please contact Richard Neilson, Huntington Power Plant Environmental Engineer at (435) 687-4334 or me at (435) 687-4211.

Sincerely,

Darrell Cunningham
Managing Director Huntington Plant
Responsible Official

Enclosures: Emissions Testing Report for PacifiCorp Huntington Unit 1 – Particulate Matter Compliance Testing
Emissions Testing Report for PacifiCorp Huntington Unit 2 – Particulate Matter Compliance Testing

cc: David Barnhisel
Steve Jensen
Director, USEPA Region VIII, w/enclosures



Emissions Testing Report for PacifiCorp
Huntington Unit 1
Huntington, Utah

Particulate Matter Compliance Testing

40 CFR Part 63, Subpart UUUUU

Test Date: February 9, 2016

Project Code PC16-0001.4

Executive Summary

EMCo was contracted by PacifiCorp to conduct compliance testing at the Huntington Power Plant near Huntington, Utah. Testing was performed to determine emission rates of particulate matter (PM) from the exhaust stack of Huntington Unit 1. Compliance test results are summarized in the table below; detailed test results are given in the following report.

PaciCorp Huntington Power Plant PM Compliance Test Results Summary						
Source	Parameter	Date	Average Value	Emission Limit		
Huntington Unit 1	Filterable Particulate Matter	2/9/2016	0.005	0.030 lb/mmBtu		
			0.05	0.30 lb/MW-hr		
Each result is the average of three two-hour test runs.						
<u>Abbreviations:</u> lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt hour						

Introduction

EMCo was contracted by PacifiCorp to conduct source testing services at the Huntington Power Plant near Huntington, Utah. The Huntington Plant comprises two pulverized coal-fired boilers. Huntington Unit #1 is equipped with low-NO_x burners and overfire air for nitrogen oxides (NO_x) control, a flue gas desulfurization (FGD) scrubber for sulfur dioxide (SO₂) control and pulse-jet fabric filters for particulate matter (PM) control. Testing was conducted in accordance with the requirements of 40 CFR Part 63 Subpart UUUUU, National Emission Standards for Hazardous Air Pollutants (NESHAP): Coal- and Oil-Fired Electric Utility Steam Generating Units.

Contact information for the project is listed in the table below.

Contact	Affiliation	Telephone	E-mail
Frank Zampedri Environmental Analyst	PacifiCorp	(801) 220-2169	frank.zampedri@pacificorp.com
Richard Neilson Environmental Engineer		(435) 687-4334	richard.neilson@pacificorp.com
Rob Leishman Environmental Scientist	UDEQ	(801) 536-4438	rleishman@utah.gov
Craig Kormylo Senior Project Manager	EMCo	(303) 810-2849	ckormylo@stacktest.us

Scope of Work

Testing was performed to determine concentrations and mass emission rates of particulate matter (PM) for comparison to the applicable emission limits listed in the table below.

Source	Regulation	Parameter	Emission Limit
Huntington Unit 1	NESHAP UUUUU	PM (lb/mmBtu)	0.030 lb/mmBtu
		PM (lb/MW-hr)	0.30 lb/MW-hr
Abbreviations: lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt-hour			

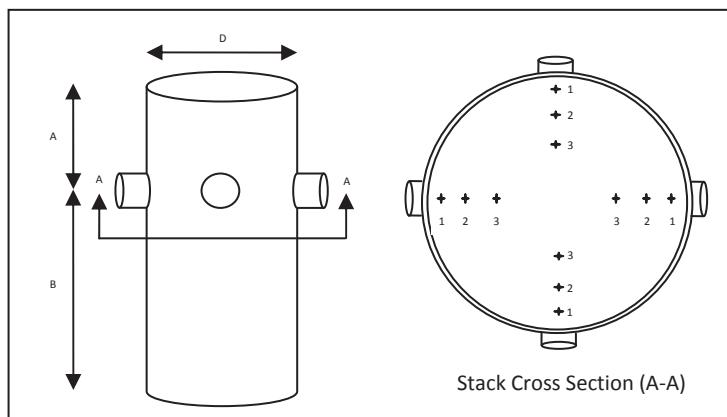
Testing Methods

EMCo used the following EPA Reference Methods for the testing program. No deviations from the Reference Methods were noted.

Parameter	EPA Reference Methods	Test Runs/Duration	Target Sample Volume
PM (lb/mmBtu)	1, 2, 3B, 4, 5*, 19	3 @ 2 hr	2 dscm (70.63 dscf)**
*In accordance with Table 5 of NESHAP Subpart UUUUU, the front-half temperature was set at 320° ± 25°F.			
**Sample volume from Table 2 of NESHAP Subpart UUUUU, doubled in accordance with §63.10005.			

Testing Location

The Huntington Unit #1 exhaust sampling location consists of a vertical, circular stack with four orthogonal sampling ports located at least six diameters downstream and two diameters upstream of the nearest flow disturbances. PM testing was performed across a grid of 12 points determined using EPA Method 1. See the schematic below.



Huntington Test Diagram	
Unit #	1
Diameter (D)	323.3"
Upstream Distance (A)	>220'
Downstream Distance (B)	>266'
Sample Point Distances from Stack Wall	
Traverse Point 1	14.1"
Traverse Point 2	47.3"
Traverse Point 3	95.7"

Test Results

The results of the testing program are given in the tables below. Detailed test results are located in Appendix A, along with sample calculations for all computed values.

PacificCorp Huntington Unit 1 PM Compliance Test Results Summary (2/9/2016)						
Parameter	Run #1	Run #2	Run #3	Average	QA Specification	Emission Limit***
Start Time	7:02	9:30	12:11	—	—	—
Stop Time	9:08	11:36	14:19	—	—	—
Sample Gas Volume (dscf)	71.42	72.76	71.87	72.02	>70.63*	—
Isokinetic Variation (%)	102.0	102.4	98.3	100.9	100 ± 10%	—
Filterable PM (lb/mmBtu)	0.006	0.003	0.008	0.005	—	0.030
Boiler Load (MW)	478	478	478	478	>468**	—
Filterable PM (lb/MW-hr)	0.05	0.03	0.08	0.05	—	0.30

* Sample volume from Table 2 of NESHAP Subpart UUUUUU, doubled in accordance with §63.10005.
**90% of design capacity, in accordance with §63.10007(a)(2).
***As shown, average PM emissions were less than 50% of the applicable emission limit, qualifying the unit for Low Emitting EGU (LEE) status.

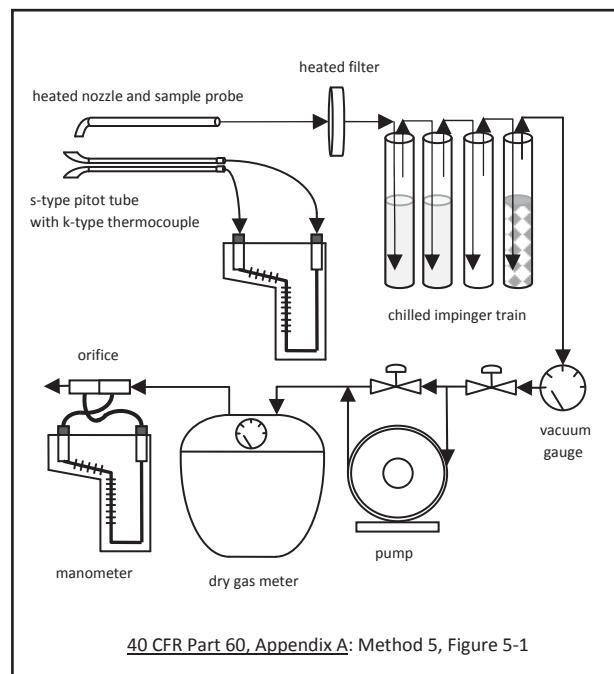
Testing Equipment

All testing equipment was housed in a climate-controlled mobile analytical laboratory designed and built by EMCo. All required quality assurance tests were performed as required by the applicable Reference Methods. Detailed equipment descriptions are given in the table below.

Parameter	Equipment	EPA Reference Method(s)
Particulate Matter (PM)	Heated probe with glass nozzle and stainless steel probe liner Quartz fiber filter S-type pitot tube K-type thermocouple Inclined-vertical manometer Dry gas meter Digital scale Analytical balance	1, 2, 3B, 4, 5B, 19

Test Details

Particulate matter testing was performed using EPA Methods 1, 2, 3B, 4 and 5. Each test run was 120 minutes in duration. Sampling was performed along a grid of points determined using EPA Method 1. Exhaust gas flow measurements were taken using an S-type pitot tube, K-type thermocouple and inclined-vertical manometer in accordance with EPA Method 2. A sample of exhaust gas was withdrawn from the stack at an isokinetic flow rate through a heated stainless steel nozzle and probe, through a heated quartz-fiber filter, through four chilled glass impingers containing known masses of water or silica gel, and through a dry gas meter. (See Figure 5-1 at right.) The default dry molecular weight for combustion sources (30 lbs/lb-mole) listed in EPA Method 3 was combined with pressure and temperature measurements to calculate stack gas velocity in accordance with EPA Method 2. Stack gas moisture concentrations were determined gravimetrically in accordance with EPA Method 4. Following each sampling period, the filter and rinses of the nozzle and probe were recovered and returned to EMCo's laboratory for gravimetric analysis. Following analysis, the particulate mass captured during each test run was combined with concurrent flow and moisture data to calculate particulate matter emissions in units of pounds per hour (lb/hr). The particulate mass captured during each test run was combined with concurrent CO₂ concentration data from the plant CEMS¹ and the appropriate fuel F-factor from EPA Method 19 (1,800 scf/mmBtu) to calculate PM emissions in units of pounds per million British thermal units (lb/mmBtu) for comparison to the applicable emission limit.



¹ EPA Method 3B §6.0 states "As an alternative to the sampling apparatus and systems described herein, other sampling systems may be used, provided such systems are ... capable of yielding acceptable results." As NESHAP UUUUUU requires certified Part 75 CEMS CO₂ data to calculate SO₂ and mercury emissions in units of lb/mmBtu, CEMS CO₂ data are considered acceptable for PM emission calculations as well.

Appended Information

Supporting data for this testing program are included as follows.

Appendix A: Test Summary

- Data Reduction Spreadsheet
- Sample Calculations

Appendix B: Field Data

- Field Datasheets

Appendix C: Laboratory Data

- Gravimetric Analysis

Appendix D: CEMS Data

- Test Run CEMS Printouts

Appendix E: Calibration Information

- Dry Gas Meter Pre-Test and Post-Test Calibrations
- Critical Orifice Calibration Certificate
- AETB Certification



Project PC16-0001.4

Appendix A: Test Summary

Data Reduction Spreadsheets

Sample Calculations

Θ	Run #	1	2	3
	Start Time	7:02	9:30	12:11
	Stop Time	9:08	11:36	14:19
	Sample Time (min.)	120	120	120

EPA Method 2 Data		1	2	3	Average
Inputs					
D _s	Stack Diameter (inches)	323.3	323.3	323.3	323.3
P _{bar}	Barometric Pressure ("Hg)	23.87	23.87	23.87	23.9
P _g	Stack Static Pressure ("H ₂ O)	-2.4	-2.4	-2.4	-2.4
C _p	Pitot Tube Coefficient (unitless)	0.84	0.84	0.84	0.84
VΔP _{avg}	Avg. Velocity Head of Stack Gas V("H ₂ O)	0.7620	0.7744	0.8034	0.7799
T _s	Stack Gas Temperature (°F)	110	112	112	111
Calculations					
A	Stack Area (ft ²)	570.084	570.084	570.084	570.084
P _g	Stack Static Pressure ("Hg)	-0.18	-0.18	-0.18	-0.18
M _d	Stack Gas Molecular Weight, dry basis (lb/lb-mole)	30.00	30.00	30.00	30.00
M _s	Stack Gas Molecular Weight, wet basis (lb/lb-mole)	28.73	28.75	28.64	28.71
P _s	Absolute Stack Pressure ("Hg)	23.69	23.69	23.69	23.69
T _{s(abs)}	Absolute Stack Gas Temperature (°R)	570	572	572	571
V _s	Stack Gas Velocity (ft/sec)	50.1	51.0	53.0	51.3
Q	Stack Gas Dry Volumetric Flow Rate (dscf/hr)	67,425,296	68,469,056	70,455,315	68,783,222
Q	Stack Gas Dry Volumetric Flow Rate (dscf/min)	1,123,755	1,141,151	1,174,255	1,146,387

CEMS Diluent Data		1	2	3	Average
CO ₂ (%vw)		10.9	10.9	10.9	10.9
CO ₂ (%vd)		12.2	12.2	12.3	12.2

EPA Method 4 Data		1	2	3	Average
Inputs					
V _{lc}	Volume of Water Condensed (mL)	179.0	180.3	195.3	184.9
V _m	Volume of Stack Gas Collected (dcf)	89.728	92.261	91.105	91.031
Y	Meter Calibration Factor (unitless)	0.9827	0.9827	0.9827	0.9827
ΔH	Pressure Differential Across Orifice ("H ₂ O)	1.35	1.45	1.55	1.5
T _m	Temperature at Gas Meter (°F)	62	67	67	65
Calculations					
P _m	Absolute Pressure at Gas Meter ("Hg)	23.97	23.98	23.98	23.98
T _m	Absolute Temperature at Gas Meter (°R)	522	527	527	525.3
V _{wc(std)}	Volume of Water Condensed (scf)	8.42	8.48	9.19	8.70
V _{m(std)}	Sample Gas Volume (dscf)	71.42	72.76	71.87	72.02
B _{ws act}	Observed Stack Gas Moisture Content (%/100)	0.106	0.104	0.113	0.108
B _{ws sat}	Saturated Moisture Content (%/100)	0.110	0.116	0.116	0.114
B _{ws}	Moisture Content Used (%/100)	0.106	0.104	0.113	0.108

EPA Method 5 Data		1	2	3	Average
Inputs					
D _n	Nozzle diameter (")	0.233	0.233	0.233	0.233
C1	Mass of PM collected on filter (mg)	4.6	3.4	5.9	4.6
C2	Mass of PM collected in rinses (mg)	7.8	3.3	11.1	7.4
Emission Calculations					
F _c	Fuel F-Factor (scf/mmBtu)	1800	1800	1800	1800
A _n	Cross-sectional area of nozzle (ft ²)	2.96E-04	2.96E-04	2.96E-04	2.96E-04
I	Isokinetic variation (%)	102.0	102.4	98.3	100.9
m _n	Total Filterable PM mass less blank (mg)	12.4	6.7	17.0	12.0
C _s	Filterable Particulate concentration (gr/dscf)	0.003	0.001	0.004	0.003
C _s	Filterable Particulate concentration (lb/dscf)	3.83E-07	2.03E-07	5.21E-07	3.69E-07
E _{lb/hr}	Filterable Particulate mass emission rate (lb/hr)	26	14	37	25
	Boiler Load (MW)	478	478	478	478
	Filterable Particulate mass emission rate (lb/MW-hr)	0.05	0.03	0.08	0.05
F _c	Filterable Particulate mass emission rate (lb/mmBtu)	0.006	0.003	0.008	0.005
8760 hrs/yr	Filterable Particulate mass emission rate (tons/year)	113	61	161	112

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

Variables

Variable	Value	Definition	Unit of Measurement
D _s	323.3	Stack Diameter	inches
A	570.08	Cross-Sectional Area of the Stack	ft ²
P _g	-2.40	Stack Static Pressure	in. H ₂ O
P _g	-0.18	Stack Static Pressure	in. Hg
%CO ₂	12.2	Concentration of Carbon Dioxide	Dry Volume Percent (%vd)
M _d	30.00	Dry Molecular Weight of the Stack Gas (default)	lb/lb-mole
P _{bar}	23.87	Barometric Pressure	in. Hg
ΔH	1.35	Pressure Differential across Orifice	in. H ₂ O
P _m	23.97	Absolute Pressure at Gas Meter	in.Hg
t _m	62	Temperature at Gas Meter	°F
T _m	522	Absolute Temperature at Gas Meter	°R
K1	0.04706	Conversion Factor	ft ³ /mL
V _{lc}	179.0	Volume of Water Condensed	g
V _{wc(std)}	8.42	Volume of Water Condensed	scf
K ₄	17.64	Constant	°R/in.Hg
Y	0.9827	Meter Calibration Factor	Unitless
V _m	89.728	Volume of Stack Gas Collected	dcf
V _{m(std)}	71.422	Sample Gas Volume	dscf
B _{ws}	0.106	Stack Gas Moisture Content	%/100
M _s	28.73	Actual Molecular Weight of the Stack Gas	lb/lb-mole
P _s	23.69	Absolute Stack Pressure	in. Hg
T _s	110	Average Stack Temperature	°F
T _{s(abs)}	570	Average Absolute Stack Temperature	°R
K _p	85.49	Conversion Factor	(ft/sec) x V(((lb/lb-mole)(in.Hg))/((°R)(in.H ₂ O)))
C _p	0.84	Pitot Coefficient	Dimensionless
AvgVΔp	0.762	Average Square Root of Velocity Head Readings	in. H ₂ O
V _s	50.07	Average Stack Gas Velocity	ft/sec
T _{std}	528	Standard Absolute Temperature	°R
P _{std}	29.92	Standard Absolute Pressure	in. Hg
Q	67,425,296	Dry Volumetric Flow Rate Corrected to Standard Conditions	dscf/hr
D _n	0.233	Nozzle Diameter	inches
A _n	2.96E-04	Cross-Sectional Area of the Nozzle	ft ²
m _n	12.40	Total PM and CPM Mass	mg
C _s	3.83E-07	Particulate Concentration	lb/dscf
E _{lb/hr}	25.8	PM Mass Emission Rate	pounds per hour
F _c	1800	F-Factor from EPA Method 19	scf/mmBtu
E _{lb/mmBtu}	0.006	PM Mass Emission Rate	pounds per million Btu
E _{tons/yr}	113.0	PM Mass Emission Rate	tons per year
K5	0.0945	Constant	(in.Hg · min) / (°R · sec)
Θ	120	Sample Time	minutes
I	102.0 %	Isokinetic variation	percent

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$A = \pi(D_s/24)^2$$

$$\pi(323.3/24)^2$$

$$= 570.08 \text{ ft}^2$$

$$P_g = P_{bar}/13.6$$

$$= -2.4/13.6$$

$$= -0.18 \text{ in. Hg}$$

$$M_d = 30.00 \text{ lb/lb-mole}$$

$$P_m = P_{bar} + (\Delta H/13.6)$$

$$= 23.87 + (1.35/13.6)$$

$$= 23.97 \text{ in. Hg}$$

$$T_m = 460 + t_m$$

$$= 460 + 62$$

$$= 522 \text{ R}$$

$$V_{wc(std)} = K_1 \times V_{lc}$$

$$= 0.04706 \times 179$$

$$= 8.42 \text{ scf} \quad (Eq. 4-1)$$

$$V_{m(std)} = \frac{K_4 \times Y \times V_m \times P_m}{T_m}$$

$$= \frac{17.64 \times 0.9827 \times 89.728 \times 23.97}{522}$$

$$= 71.42 \text{ dscf} \quad (Eq. 4-3)$$

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$

$$= \frac{8.42}{8.42 + 71.42}$$

$$= 0.106 (\%/100) \quad (Eq. 4-4)$$

$$M_s = M_d \times (1 - B_{ws}) + (18.0 \times B_{ws})$$

$$= 30.00 \times (1 - 0.106) + (18.0 \times 0.106)$$

$$= 28.73 \text{ lb/lb-mole} \quad (Eq. 2-6)$$

$$P_s = P_{bar} + P_g$$

$$= 23.87 + (-0.18)$$

$$= 23.69 \text{ in. Hg}$$

$$T_{s(abs)} = 460 + T_s$$

$$= 460 + 110$$

$$= 570 \text{ R}$$

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$V_s = K_p \times C_p \times Avgv/\Delta p \times \sqrt{\frac{T_{s(abs)}}{(P_s \times M_s)}}$$

$$= 85.49 \times 0.84 \times 0.762 \times \sqrt{\frac{570}{(23.69 \times 28.73)}}$$

$$= 50.1 \text{ ft/sec}$$

(Eq. 2-7)

$$Q = 3600 \times (1 - B_{ws}) \times (V_s) \times (A) \times \frac{(T_{std} \times P_s)}{(T_{s(abs)} \times P_{std})}$$

$$= 3600 \times (1 - 0.106) \times (50.07) \times (570.08) \times \frac{(528 \times 23.69)}{(570 \times 29.92)}$$

$$= 67,425,296 \text{ dscf/hr}$$

(Eq. 2-8)

$$A_n = \pi(D_n/24)^2$$

$$\pi(0.233/24)^2$$

$$= 2.96E-04 \text{ ft}^2$$

$$C_s = \frac{m_n}{(mg/g)(g/lb)(V_{m(std)})}$$

$$= \frac{12.4}{(1000)(453.592)(71.422)}$$

$$= 3.83E-07 \text{ lb/dscf}$$

$$E_{lb/hr} = C_s \times Q$$

$$= 3.83E-07 \times 67425296$$

$$= 25.8 \text{ lb/hr}$$

$$E_{lb/mmBtu} = \frac{C_s \times F_c \times 100}{(CO_2\%vd)}$$

$$= \frac{3.83E-07 \times 1800 \times 100}{(12.2)}$$

$$= 0.006 \text{ lb/mmBtu}$$

$$E_{tons/yr} = \frac{E_{lb/hr} \times (\text{Hrs/yr})}{(\text{lbs/ton})}$$

$$= \frac{25.81 \times 8,760}{2000}$$

$$= 113.0 \text{ tons/year}$$

$$I = \frac{K5 \times T_{s(abs)} \times V_{m(std)} \times 100}{P_{s(abs)} \times V_s \times A_n \times \Theta \times (1 - B_{ws})}$$

$$= \frac{0.0945 \times 570 \times 71.422 \times 100}{23.69 \times 50.07 \times 3.0E-04 \times 120 \times (1 - 0.106)}$$

$$= 102.0 \%$$

(Eq. 5-7)



Project PC16-0001.4
Appendix B: Field Data
Field Datasheets

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 16-014	Operator(s):	W/S, S/S
Client:	Pacific Corp	Barometric pressure ("Hg):	23.87
Source:	Huntington 1	Static pressure ("H ₂ O):	-2.4
Date:	2/9/16	Leak Check ("H ₂ O @ Vac):	0.09 @ 15"
Run #	1	Leak Check ("H ₂ O @ Vac):	0.00 @ 10"
Meterbox ID:	M5-2	Pitot ID / Coeff:	0.84
Meterbox Y = .9827	ΔH@= 1.79	Pitot Leak Check:	✓
O ₂ %:	7.1	Nozzle Diameter:	0.233
CO ₂ %:	11.6	K Factor:	2.29 @ 34 @ 20min
Start Time	7:02	Stop Time	9:08

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	780.0	959.0
Total	179.0	
Filter ID:	727	
Tin ID:	1431	

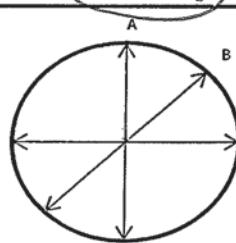
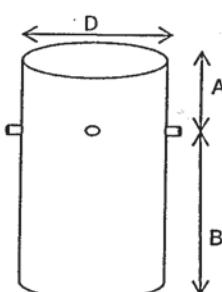
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity Δp ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								997.525			
1-1	10	106	310	321	0.46	1.1	3	6.0	55	50	49
-2	20	112	311	321	0.60	1.4	5	13.7	62	52	58
-3	30	111	315	321	0.68	1.6	5	21.4	66	54	59
2-1	40	110	312	321	0.45	1.0	4	28.0	66	56	64
-2	50	111	310	320	0.61	1.4	4	34.9	68	57	63
-3	60	111	311	321	0.70	1.6	5	43.1	69	59	62
3-1	70	110	310	319	0.45	1.0	4	49.3	69	59	65
-2	80	110	309	320	0.60	1.4	5	56.7	69	60	61
-3	90	110	310	319	0.70	1.6	5	64.7	71	61	59
4-1	100	110	308	320	0.46	1.1	4	71.3	70	61	58
-2	110	110	310	320	0.61	1.4	5	79.1	70	61	55
-3	120	111	303	320	0.70	1.6	5	87.253	71	61	55
12	120	110	303	319	0.7620	1.350	5	86.11118	62	65	
Total	Total	Average	Minimum	Minimum	Avg VΔp	Average	Max.	Total	Average	Maximum	
								89.728			

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A=.233

B=.233

C=.233

Average=.233

Max Difference=0

(Must be < 0.004 in.)

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 16-01	Operator(s):	WS, SIS
Client:	pacificsp	Barometric pressure ("Hg):	23.87
Source:	Huntington 1	Static pressure ("H ₂ O):	-0.4
Date:	2/9/16	Leak Check ("H ₂ O @ Vac):	0.00 @ 10"
Run #	2	Leak Check ("H ₂ O @ Vac):	0.00 @ 9"
Meterbox ID:	M5-2	Pitot ID / Coeff:	0.84
Meterbox Y =	9827	ΔH@=	1.79
O ₂ %:	7.1	Pitot Leak Check:	✓
CO ₂ %:	11.6 12.5	Nozzle Diameter:	0.233
Start Time	9:30	K Factor:	2.40 2.35
		Stop Time	11:36

Impinger Weights (x.g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	755.9	936.2
Total	180.3	

Filter ID: 736

Tin ID: 1432

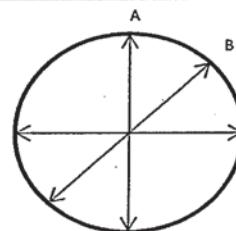
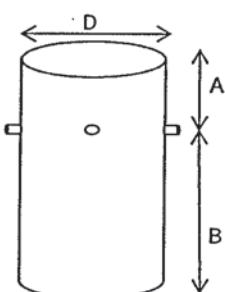
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity ΔP ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								87.378			
1-1	10	112	300	317	0.46	1.1	4	94.3	68	61	54
-2	20	112	301	321	0.61	1.46	5	102.0	70	61	56
-3	30	112	302	319	0.71	1.7	5	109.6	71	61	58
2-1	40	112	301	321	0.48	1.15	5	116.6	70	62	56
-2	50	111	302	319	0.63	1.5	5	124.1	71	62	54
-3	60	111	300	322	0.74	1.8	6	132.5	72	62	55
3-1	70	112	301	320	0.41	1.1	4	140.0	70	63	53
-2	80	112	302	320	0.62	1.5	4	147.9	71	63	49
-3	90	112	303	319	0.73	1.75	5	156.4	72	63	47
4-1	100	113	300	320	0.48	1.15	3	163.7	71	63	46
-2	110	113	301	320	0.61	1.5	4	171.5	72	63	46
-3	120	113	302	321	0.71	1.7	4	179.639	72	63	46
12	120	(112)	300	317	0.7744	1.45	6	(92.261)	(67)		58
Total	Total	Average	Minimum	Minimum	Avg-VAp	Average	Max.	Total	Average		Maximum

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A=

B=

C=

Average =

Max Difference =

(Must be < 0.004 in.)

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	PC 16-01	Operator(s):	WS, STS
Client:	pacificsp	Barometric pressure ("Hg):	23.87
Source:	Huntington 1	Static pressure ("H ₂ O):	-2.4
Date:	2/9/16	Leak Check ("H ₂ O @ Vac):	0.00@ 10"
Run #	3	Leak Check ("H ₂ O @ Vac):	0.00@ 11"
Meterbox ID:	M5-2	Pitot ID / Coeff:	0.84
Meterbox Y:	9327	Pitot Leak Check:	✓
O ₂ %:	7.1	Nozzle Diameter:	0.233
CO ₂ %:	11.6 12.5	K Factor:	2.40
Start Time	12:11	Stop Time	14:19

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	770.8	966.1
Total	195.3	

Filter ID: 710
Tin ID: 1434

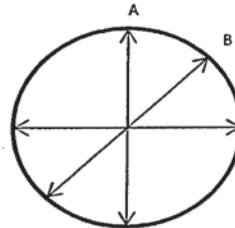
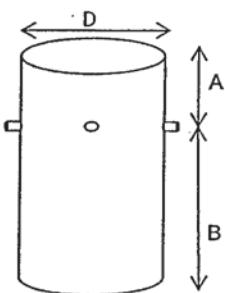
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity Δp ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								180.519			
1-1	10	112	317	319	.65	1.6	5	188.3	64	61	39
-2	20	113	321	320	.73	1.8	5	196.8	67	62	43
-3	30	112	323	320	.73	1.8	5	204.966	69	62	46
2-1	40	112	311	323	0.52	1.2	5	212.3	71	62	48
-2	50	112	301	320	0.65	1.5	5	219.4	72	63	48
-3	60	112	303	320	0.73	1.8	6	226.9	73	63	48
3-1	70	112	305	320	0.51	1.2	5	233.5	72	64	47
-2	80	112	315	319	0.65	1.5	5	241.1	73	64	47
-3	90	113	314	320	0.73	1.8	7	249.3	74	64	47
4-1	100	113	313	319	0.51	1.2	5	256.5	73	65	47
-2	110	113	310	320	0.65	1.5	6	263.6	74	65	48
-3	120	113	311	320	0.72	1.7	7	271.624	74	65	48
12	120	113	301	319	0.8034	1.550	7	91.105	67		48
Total	Total	Average	Minimum	Minimum	Avg VAp	Average	Max.	Total	Average		Maximum

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A=

B=

C=

Average =

Max Difference =

(Must be < 0.004 in.)



Project PC16-0001.4
Appendix C: Lab Data
Gravimetric Analysis

Project Code:	PC16-1.4
Date Finalized:	2/18/2016
Analyst:	Parks

Laboratory Results Summary	
Sample ID	Filterable Particulate Matter (mg)
Huntington 1, Run #1	12.4
Huntington 1, Run #2	6.7
Huntington 1, Run #3	17.0
No blank corrections were performed.	

Analytical Narrative

Quartz fiber filters were dessicated and tared to a constant weight in the EMCo laboratory prior to sampling. Following testing, the filters were dessicated for at least 24 hours, then weighed to a constant weight (± 0.5 mg). The acetone rinses were measured to the nearest milliliter, transferred to tared aluminum weighing dishes, taken to dryness under a fume hood, then weighed to a constant weight (± 0.5 mg). Each result above represents total filterable particulate matter for each test run (acetone rinse + filter catch), with no blank correction performed unless otherwise indicated.

Instrumentation

All measurements were taken using a Torbal Model AGCN200 Analytical Balance under laboratory conditions. The instrument is auto-calibrated and challenged with three NIST-traceable reference weights daily.

Detection Limit / Sensitivity

All measurements are recorded to 0.0001g (0.1mg).

Notes

No deviations from the analytical procedure from EPA Method 5 were noted. All samples were received in good condition. After analysis, all samples are archived for a period of one year.

Attachments

Gravimetric Analysis Logs

Sample Chain of Custody



EPA Method 5 Gravimetric Analysis Log

Project Code: PC16-1.4
Unit ID: Huntington 1

Front-Half Particulate Matter Filter Catch

Filter #	Run #1		Run #2		Run #3	
	727	736	710			
Final Weight	Date	Weight (g)	Date	Weight (g)	Date	Weight (g)
Tare Weight (g)	2/15/16	0.3578	2/15/16	0.3572	2/15/16	0.3579
Filter Catch (g)	2/17/15	0.3532	2/18/15	0.3538	2/18/15	0.352
		0.0046		0.0034		0.0059

Front-Half Particulate Matter Acetone Rinse Catch

Dish #	Run #1		Run #2		Run #3	
	1431	1432	1434			
Final Weight	Date	Weight (g)	Date	Weight (g)	Date	Weight (g)
Tare Weight (g)	2/15/16	6.4737	2/15/16	6.392	2/15/16	6.4574
Total Rinse Catch (g)	1/11/16	6.4659	1/11/16	6.3887	1/11/16	6.4463
		0.0078		0.0033		0.0111

Total Particulate Catch

	Run #1	Run #2	Run #3
Filter Catch (g)	0.0046	0.0034	0.0059
+ Rinse Catch (g)	0.0078	0.0033	0.0111
- Acetone Blank (g)	0.0000	0.0000	0.0000
Total PM (g)	0.0124	0.0067	0.0170

Laboratory Chain of Custody Record

Project Code:	PC16-14		
Client:	PACIFICORP		
Facility:	HUNTINGTON		
Unit:	1, 2		
Sample Date(s):	2/9 & 2/10/16		
Project Manager:	Koranyi, L.		
Sample ID / Run #	Filter ID	Tin ID	Notes
UNIT 1 / RUN 1	7207	1431	
2	736	1432	
3	710	1434	
UNIT 2 / RUN 1	920	1418	
2	921	1443	
3	922	1413	
Relinquished by: CK			Date: 2/11
Received by: MP			Date 2/11



Project PC16-0001.4
Appendix D: CEMS Data
CEMS Printouts for Test Runs

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 07:02 Through 02/09/2016 09:08

Time Online Criteria: 1 minute(s)

Source Parameter Unit		UNIT1				
		BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
02/09/16	07:02	24.038	11.1	2.4	103.70	477
02/09/16	07:03	24.038	11.2	2.4	104.38	477
02/09/16	07:04	24.038	11.0	2.4	105.29	475
02/09/16	07:05	24.038	11.0	2.4	105.67	474
02/09/16	07:06	24.038	11.0	2.4	105.86	473
02/09/16	07:07	24.038	11.0	2.4	106.07	473
02/09/16	07:08	24.039	11.0	2.4	105.08	476
02/09/16	07:09	24.038	11.0	2.4	104.66	480
02/09/16	07:10	24.038	11.0	2.4	104.40	483
02/09/16	07:11	24.038	11.0	2.3	104.26	484
02/09/16	07:12	24.038	11.0	2.4	104.43	484
02/09/16	07:13	24.039	11.0	2.4	104.53	482
02/09/16	07:14	24.038	11.0	2.3	104.03	482
02/09/16	07:15	24.038	11.0	2.4	103.59	481
02/09/16	07:16	24.039	11.0	2.3	103.73	479
02/09/16	07:17	24.039	11.0	2.4	103.74	476
02/09/16	07:18	24.039	10.9	2.4	103.46	476
02/09/16	07:19	24.038	10.8	2.4	103.36	475
02/09/16	07:20	24.038	10.8	2.4	103.92	473
02/09/16	07:21	24.038	10.8	2.4	104.56	473
02/09/16	07:22	24.039	10.7	2.4	104.77	473
02/09/16	07:23	24.038	10.6	2.4	104.60	474
02/09/16	07:24	24.038	10.6	2.4	104.37	473
02/09/16	07:25	24.038	10.6	2.4	104.38	473
02/09/16	07:26	24.039	10.6	2.4	104.21	474
02/09/16	07:27	24.039	10.6	2.3	104.70	474
02/09/16	07:28	24.039	10.6	2.4	104.04	472
02/09/16	07:29	24.039	10.6	2.4	103.70	471
02/09/16	07:30	24.039	10.6	2.4	104.01	472
02/09/16	07:31	24.039	10.6	2.4	104.06	473
02/09/16	07:32	24.040	10.6	2.4	103.89	474
02/09/16	07:33	24.040	10.8	2.3	103.26	474
02/09/16	07:34	24.041	10.9	2.4	102.42	476
02/09/16	07:35	24.042	11.0	2.3	101.81	479
02/09/16	07:36	24.042	11.1	2.4	101.57	482
02/09/16	07:37	24.042	11.2	2.4	101.56	485
02/09/16	07:38	24.042	11.2	2.3	101.60	486
02/09/16	07:39	24.043	11.1	2.3	101.77	487
02/09/16	07:40	24.043	11.0	2.3	102.17	489
02/09/16	07:41	24.043	11.0	2.3	102.30	488
02/09/16	07:42	24.043	11.0	2.3	102.61	485
02/09/16	07:43	24.043	11.0	2.3	102.52	483
02/09/16	07:44	24.044	10.9	2.3	102.53	479
02/09/16	07:45	24.044	10.5	2.3	102.91	476

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 07:02 Through 02/09/2016 09:08

Time Online Criteria: 1 minute(s)

02/09/16	07:46	24.044	10.9	2.3	102.67	475
02/09/16	07:47	24.044	10.9	2.3	102.42	475
02/09/16	07:48	24.045	10.9	2.3	102.48	475
02/09/16	07:49	24.045	10.8	2.3	103.09	477
02/09/16	07:50	24.045	10.8	2.3	103.29	477
02/09/16	07:51	24.045	10.8	2.3	102.68	477
02/09/16	07:52	24.046	10.8	2.3	102.71	477
02/09/16	07:53	24.046	10.8	2.4	102.93	478
02/09/16	07:54	24.046	10.8	2.3	102.78	478
02/09/16	07:55	24.046	10.9	2.4	102.30	479
02/09/16	07:56	24.048	11.0	2.3	102.33	479
02/09/16	07:57	24.048	10.9	2.3	102.85	479
02/09/16	07:58	24.047	10.8	2.3	102.88	478
02/09/16	07:59	24.048	10.9	2.3	102.47	477
02/09/16	08:00	24.048	10.9	2.3	102.27	478
02/09/16	08:01	24.049	11.0	2.4	102.02	478
02/09/16	08:02	24.049	11.0	2.3	101.72	479
02/09/16	08:03	24.049	10.9	2.3	101.83	480
02/09/16	08:04	24.049	10.9	2.3	102.00	481
02/09/16	08:05	24.049	7.2 I	2.4	101.93	480
02/09/16	08:06	24.049	8.7 I	2.3	102.05	479
02/09/16	08:07	24.050	11.0 I	2.3	102.31	478
02/09/16	08:08	24.050	10.9 I	2.3	102.40	478
02/09/16	08:09	24.050	10.9	2.3	102.30	477
02/09/16	08:10	24.050	10.9	2.3	102.41	478
02/09/16	08:11	24.049	10.9	2.3	102.37	477
02/09/16	08:12	24.049	10.9	2.3	102.14	478
02/09/16	08:13	24.049	10.9	2.3	101.87	479
02/09/16	08:14	24.050	11.0	2.3	101.75	480
02/09/16	08:15	24.050	10.9	2.3	102.07	480
02/09/16	08:16	24.051	10.9	2.3	102.31	480
02/09/16	08:17	24.051	10.9	2.3	102.46	479
02/09/16	08:18	24.051	10.9	2.3	102.72	478
02/09/16	08:19	24.052	10.9	2.3	102.67	478
02/09/16	08:20	24.052	10.9	2.3	102.59	477
02/09/16	08:21	24.052	10.9	2.3	102.46	477
02/09/16	08:22	24.052	10.8	2.3	102.67	475
02/09/16	08:23	24.051	10.9	2.3	103.10	475
02/09/16	08:24	24.050	10.9	2.3	102.94	475
02/09/16	08:25	24.050	10.9	2.3	102.54	476
02/09/16	08:26	24.051	10.9	2.3	102.23	477
02/09/16	08:27	24.051	11.0	2.4	101.60	478
02/09/16	08:28	24.051	11.0	2.3	101.26	479
02/09/16	08:29	24.051	11.0	2.4	101.58	479
02/09/16	08:30	24.051	11.0	2.3	102.28	478
02/09/16	08:31	24.051	11.0	2.3	102.57	477
02/09/16	08:32	24.051	10.9	2.3	102.29	476
02/09/16	08:33	24.051	10.8	2.3	102.23	476

C = Calibration
S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated: 02/09/16 12:46 Huntington 1 Q1 PM

Page 20 of 32

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 07:02 Through 02/09/2016 09:08

Time Online Criteria: 1 minute(s)

02/09/16	08:34	24.051	10.8	2.3	102.59	477
02/09/16	08:35	24.050	10.9	2.3	102.34	477
02/09/16	08:36	24.050	10.9	2.3	101.92	477
02/09/16	08:37	24.050	10.9	2.3	101.83	477
02/09/16	08:38	24.050	11.0	2.3	101.53	477
02/09/16	08:39	24.050	11.0	2.3	101.23	477
02/09/16	08:40	24.050	11.0	2.3	101.71	477
02/09/16	08:41	24.050	10.9	2.4	101.92	478
02/09/16	08:42	24.050	11.0	2.4	101.82	478
02/09/16	08:43	24.050	11.0	2.4	101.92	479
02/09/16	08:44	24.050	11.0	2.3	101.53	480
02/09/16	08:45	24.049	11.0	2.3	101.11	480
02/09/16	08:46	24.050	11.0	2.3	101.38	480
02/09/16	08:47	24.050	11.1	2.3	101.63	479
02/09/16	08:48	24.050	11.0	2.3	101.67	477
02/09/16	08:49	24.050	11.0	2.3	101.59	476
02/09/16	08:50	24.050	11.0	2.4	101.83	477
02/09/16	08:51	24.050	11.0	2.3	102.13	477
02/09/16	08:52	24.050	11.0	2.3	102.05	478
02/09/16	08:53	24.051	11.0	2.3	101.89	479
02/09/16	08:54	24.051	11.0	2.3	101.33	478
02/09/16	08:55	24.051	11.0	2.3	101.23	478
02/09/16	08:56	24.050	11.0	2.3	101.54	479
02/09/16	08:57	24.050	11.0	2.3	101.69	478
02/09/16	08:58	24.050	11.0	2.3	101.77	478
02/09/16	08:59	24.051	11.0	2.3	101.50	478
02/09/16	09:00	24.051	11.0	2.3	101.28	480
02/09/16	09:01	24.050	11.1	2.3	101.32	480
02/09/16	09:02	24.050	11.1	2.3	101.63	481
02/09/16	09:03	24.050	11.0	2.3	101.90	480
02/09/16	09:04	24.051	11.0	2.3	102.06	478
02/09/16	09:05	24.052	11.0	2.3	102.41	478
02/09/16	09:06	24.052	10.9	2.3	102.52	477
02/09/16	09:07	24.053	10.9	2.3	102.38	477
02/09/16	09:08	24.053	11.0	2.3	102.73	476

Average	24.046	10.9	2.3	102.69	478
Minimum	24.038	10.6	2.3	101.11	471
Maximum	24.053	11.2	2.4	106.07	489
Summation	3,053.862	1,343.5	296.1	13,041.21	60,689

Included Data Points	127	123	127	127	127
Total number of Data Points	127	127	127	127	127

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 09:30 Through 02/09/2016 11:36

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT1				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
02/09/16 09:30	24.055	10.9	2.3	104.00	480
02/09/16 09:31	24.055	11.0	2.3	104.35	482
02/09/16 09:32	24.054	11.0	2.3	104.93	482
02/09/16 09:33	24.055	10.9	2.3	105.17	483
02/09/16 09:34	24.055	11.0	2.3	104.97	482
02/09/16 09:35	24.055	10.9	2.3	104.66	481
02/09/16 09:36	24.055	11.0	2.3	104.99	479
02/09/16 09:37	24.055	10.9	2.3	105.28	477
02/09/16 09:38	24.055	10.9	2.3	105.59	477
02/09/16 09:39	24.055	10.8	2.3	106.03	476
02/09/16 09:40	24.056	10.9	2.3	105.87	476
02/09/16 09:41	24.056	10.9	2.3	105.14	476
02/09/16 09:42	24.057	11.0	2.3	104.75	475
02/09/16 09:43	24.058	10.9	2.3	104.98	475
02/09/16 09:44	24.058	10.8	2.3	105.18	475
02/09/16 09:45	24.058	10.9	2.3	105.28	474
02/09/16 09:46	24.058	10.9	2.3	105.11	476
02/09/16 09:47	24.058	10.9	2.3	104.85	477
02/09/16 09:48	24.058	10.9	2.3	104.58	478
02/09/16 09:49	24.058	10.9	2.3	104.37	478
02/09/16 09:50	24.057	10.9	2.3	104.48	476
02/09/16 09:51	24.057	10.9	2.3	104.62	476
02/09/16 09:52	24.057	10.9	2.3	104.74	476
02/09/16 09:53	24.057	10.9	2.3	104.50	476
02/09/16 09:54	24.057	10.9	2.3	104.30	477
02/09/16 09:55	24.057	10.9	2.3	104.11	477
02/09/16 09:56	24.057	10.9	2.3	104.10	478
02/09/16 09:57	24.057	11.0	2.3	103.71	479
02/09/16 09:58	24.057	11.0	2.3	103.65	479
02/09/16 09:59	24.057	11.0	2.3	104.03	479
02/09/16 10:00	24.057	11.0	2.3	104.67	479
02/09/16 10:01	24.058	10.9	2.3	105.02	479
02/09/16 10:02	24.058	10.9	2.3	104.75	478
02/09/16 10:03	24.058	10.9	2.3	104.55	477
02/09/16 10:04	24.058	11.0	2.3	104.20	478
02/09/16 10:05	24.058	11.0	2.3	103.89	479
02/09/16 10:06	24.058	11.0	2.3	104.03	479
02/09/16 10:07	24.056	10.9	2.3	104.40	479
02/09/16 10:08	24.057	10.9	2.3	104.99	480
02/09/16 10:09	24.057	10.9	2.3	104.98	480
02/09/16 10:10	24.058	11.0	2.3	104.12	478
02/09/16 10:11	24.058	10.9	2.3	103.64	478
02/09/16 10:12	24.057	10.9	2.3	103.64	477
02/09/16 10:13	24.057	10.9	2.3	103.20	477

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated: 02/09/16 12:49 PM Huntington 1 Q1 PM

Page 22 of 32

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 09:30 Through 02/09/2016 11:36

Time Online Criteria: 1 minute(s)

02/09/16	10:14	24.057	10.9	2.3	103.55	478
02/09/16	10:15	24.057	10.9	2.3	104.22	476
02/09/16	10:16	24.058	10.9	2.3	104.05	476
02/09/16	10:17	24.058	11.0	2.3	103.80	476
02/09/16	10:18	24.058	11.0	2.3	103.68	478
02/09/16	10:19	24.058	11.0	2.3	103.82	478
02/09/16	10:20	24.058	11.0	2.3	103.98	478
02/09/16	10:21	24.058	11.0	2.3	103.49	478
02/09/16	10:22	24.057	11.0	2.3	103.34	478
02/09/16	10:23	24.057	10.9	2.3	103.86	479
02/09/16	10:24	24.057	10.9	2.3	103.99	479
02/09/16	10:25	24.057	10.9	2.3	103.99	478
02/09/16	10:26	24.058	10.9	2.3	103.77	478
02/09/16	10:27	24.058	11.0	2.3	103.31	478
02/09/16	10:28	24.058	10.9	2.3	103.35	480
02/09/16	10:29	24.058	11.0	2.3	103.59	478
02/09/16	10:30	24.058	11.0	2.3	103.46	478
02/09/16	10:31	24.058	11.0	2.3	103.65	478
02/09/16	10:32	24.058	11.0	2.4	104.55	480
02/09/16	10:33	24.058	11.0	2.4	103.91	481
02/09/16	10:34	24.058	11.0	2.3	103.62	482
02/09/16	10:35	24.058	11.1	2.4	103.63	481
02/09/16	10:36	24.058	11.0	2.3	103.80	480
02/09/16	10:37	24.058	10.9	2.3	103.77	479
02/09/16	10:38	24.058	10.9	2.3	103.66	478
02/09/16	10:39	24.057	10.9	2.3	104.37	476
02/09/16	10:40	24.057	10.9	2.3	104.63	476
02/09/16	10:41	24.058	11.0	2.3	104.08	476
02/09/16	10:42	24.058	11.0	2.3	104.15	476
02/09/16	10:43	24.057	10.9	2.3	104.55	476
02/09/16	10:44	24.057	10.8	2.3	104.50	477
02/09/16	10:45	24.057	10.9	2.3	104.15	477
02/09/16	10:46	24.057	11.0	2.3	103.61	477
02/09/16	10:47	24.057	11.0	2.3	103.53	479
02/09/16	10:48	24.057	11.0	2.3	104.19	478
02/09/16	10:49	24.057	11.0	2.3	104.33	479
02/09/16	10:50	24.057	11.0	2.3	104.06	479
02/09/16	10:51	24.057	11.0	2.3	103.46	479
02/09/16	10:52	24.056	11.0	2.3	103.50	479
02/09/16	10:53	24.056	11.0	2.3	103.69	481
02/09/16	10:54	24.056	11.0	2.3	103.51	480
02/09/16	10:55	24.056	11.0	2.3	103.76	478
02/09/16	10:56	24.056	10.9	2.3	103.84	476
02/09/16	10:57	24.056	10.8	2.3	104.07	474
02/09/16	10:58	24.056	10.9	2.3	104.58	473
02/09/16	10:59	24.055	10.9	2.3	104.60	474

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated: 02/09/16 12:49 PM

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 09:30 Through 02/09/2016 11:36

Time Online Criteria: 1 minute(s)

02/09/16	11:00	24.055	10.9	2.3	104.35	476
02/09/16	11:01	24.055	11.0	2.3	103.98	479
02/09/16	11:02	24.054	11.0	2.3	103.89	480
02/09/16	11:03	24.054	10.9	2.3	104.11	480
02/09/16	11:04	24.054	11.0	2.3	103.65	479
02/09/16	11:05	24.054	11.0	2.3	104.08	479
02/09/16	11:06	24.054	10.9	2.3	104.86	477
02/09/16	11:07	24.053	10.9	2.3	105.22	476
02/09/16	11:08	24.053	10.9	2.3	104.72	474
02/09/16	11:09	24.052	10.9	2.3	104.89	475
02/09/16	11:10	24.052	10.9	2.3	104.68	477
02/09/16	11:11	24.052	11.0	2.3	104.69	478
02/09/16	11:12	24.052	11.0	2.3	104.72	480
02/09/16	11:13	24.052	11.0	2.3	104.81	482
02/09/16	11:14	24.052	11.0	2.3	105.21	483
02/09/16	11:15	24.052	11.0	2.3	105.46	481
02/09/16	11:16	24.052	10.9	2.3	105.67	480
02/09/16	11:17	24.051	10.8	2.3	106.32	478
02/09/16	11:18	24.051	10.8	2.3	106.27	477
02/09/16	11:19	24.051	10.9	2.3	105.29	477
02/09/16	11:20	24.051	11.0	2.3	105.02	479
02/09/16	11:21	24.051	11.0	2.3	105.31	479
02/09/16	11:22	24.051	10.9	2.3	105.42	479
02/09/16	11:23	24.050	11.0	2.3	106.11	479
02/09/16	11:24	24.050	10.9	2.3	106.21	478
02/09/16	11:25	24.050	10.9	2.3	105.93	478
02/09/16	11:26	24.049	10.9	2.3	105.76	477
02/09/16	11:27	24.049	10.9	2.3	105.92	476
02/09/16	11:28	24.049	10.9	2.3	105.58	477
02/09/16	11:29	24.049	10.9	2.3	105.17	477
02/09/16	11:30	24.048	10.9	2.3	104.93	476
02/09/16	11:31	24.048	10.9	2.3	104.77	478
02/09/16	11:32	24.047	11.0	2.3	104.69	479
02/09/16	11:33	24.047	10.9	2.3	104.57	480
02/09/16	11:34	24.046	10.9	2.3	104.62	480
02/09/16	11:35	24.047	10.9	2.3	104.89	479
02/09/16	11:36	24.046	10.9	2.3	105.22	477

Average	24.055	10.9	2.3	104.48	478
Minimum	24.046	10.8	2.3	103.20	473
Maximum	24.058	11.1	2.4	106.32	483
Summation	3,055.016	1,389.1	292.4	13,268.39	60,709

Included Data Points	127	127	127	127	127
Total number of Data Points	127	127	127	127	127

C = Calibration

S = Substituted

*** = Suspect**

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Report Generated: 02/09/16 12:49 PM Huntington 1 Q1 PM

Page 24 of 32

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 12:11 Through 02/09/2016 14:19

Time Online Criteria: 1 minute(s)

Source	Parameter Unit	UNIT1				
		BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEGF)	UNITLOAD (MW)
02/09/16	12:11	24.037	10.9	2.3	106.25	476
02/09/16	12:12	24.037	10.9	2.3	106.89	476
02/09/16	12:13	24.037	10.9	2.3	106.88	476
02/09/16	12:14	24.036	10.9	2.3	106.98	476
02/09/16	12:15	24.036	10.9	2.3	106.99	475
02/09/16	12:16	24.035	10.8	2.3	106.78	477
02/09/16	12:17	24.035	10.9	2.3	106.82	477
02/09/16	12:18	24.034	10.8	2.3	106.96	479
02/09/16	12:19	24.034	10.8	2.3	106.71	479
02/09/16	12:20	24.034	10.9	2.3	106.30	479
02/09/16	12:21	24.033	10.9	2.3	106.69	478
02/09/16	12:22	24.033	10.9	2.3	106.48	477
02/09/16	12:23	24.033	10.9	2.3	106.01	478
02/09/16	12:24	24.032	11.0	2.3	106.17	478
02/09/16	12:25	24.032	11.0	2.3	106.24	477
02/09/16	12:26	24.031	10.9	2.3	106.25	478
02/09/16	12:27	24.031	10.9	2.3	106.28	478
02/09/16	12:28	24.030	10.8	2.3	106.02	477
02/09/16	12:29	24.029	10.8	2.3	106.06	476
02/09/16	12:30	24.029	10.8	2.3	106.15	475
02/09/16	12:31	24.029	10.8	2.3	106.12	475
02/09/16	12:32	24.029	10.8	2.3	105.73	476
02/09/16	12:33	24.028	10.9	2.3	105.44	476
02/09/16	12:34	24.028	10.9	2.3	105.70	477
02/09/16	12:35	24.027	10.9	2.3	106.05	478
02/09/16	12:36	24.027	10.9	2.3	106.14	480
02/09/16	12:37	24.027	10.9	2.3	106.03	482
02/09/16	12:38	24.026	11.0	2.3	106.03	482
02/09/16	12:39	24.026	10.9	2.3	105.97	482
02/09/16	12:40	24.026	10.9	2.3	105.59	480
02/09/16	12:41	24.025	10.9	2.3	105.58	479
02/09/16	12:42	24.025	10.9	2.3	105.75	479
02/09/16	12:43	24.025	10.9	2.3	106.12	478
02/09/16	12:44	24.025	10.9	2.3	106.83	477
02/09/16	12:45	24.024	10.9	2.3	106.82	475
02/09/16	12:46	24.024	10.9	2.3	106.23	475
02/09/16	12:47	24.024	10.9	2.3	105.57	476
02/09/16	12:48	24.024	10.9	2.3	105.38	477
02/09/16	12:49	24.024	10.8	2.3	105.44	477
02/09/16	12:50	24.024	10.8	2.3	105.41	477
02/09/16	12:51	24.024	10.8	2.3	105.66	478
02/09/16	12:52	24.024	10.9	2.3	105.86	479
02/09/16	12:53	24.024	11.0	2.3	105.86	478
02/09/16	12:54	24.023	10.9	2.3	105.27	479
02/09/16	12:55	24.023	10.9	2.3	104.30	482
02/09/16	12:56	24.023	11.1	2.3	103.99	483

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 12:11 Through 02/09/2016 14:19

Time Online Criteria: 1 minute(s)

02/09/16	12:57	24.023	11.0	2.3	104.38	482
02/09/16	12:58	24.022	10.9	2.3	104.93	482
02/09/16	12:59	24.022	10.9	2.3	105.19	479
02/09/16	13:00	24.021	10.9	2.3	105.40	476
02/09/16	13:01	24.021	10.9	2.3	105.56	474
02/09/16	13:02	24.021	10.9	2.3	105.99	473
02/09/16	13:03	24.020	10.8	2.3	105.86	473
02/09/16	13:04	24.020	10.9	2.3	105.13	475
02/09/16	13:05	24.020	10.9	2.3	104.91	476
02/09/16	13:06	24.020	11.0	2.3	104.61	479
02/09/16	13:07	24.020	11.0	2.3	104.35	480
02/09/16	13:08	24.019	11.0	2.3	104.76	480
02/09/16	13:09	24.019	11.0	2.3	105.15	480
02/09/16	13:10	24.019	11.0	2.3	105.70	479
02/09/16	13:11	24.019	10.9	2.3	105.62	478
02/09/16	13:12	24.018	10.9	2.3	105.73	476
02/09/16	13:13	24.018	10.9	2.3	105.93	476
02/09/16	13:14	24.018	10.9	2.3	105.83	477
02/09/16	13:15	24.017	10.9	2.3	105.33	478
02/09/16	13:16	24.017	11.0	2.3	105.26	479
02/09/16	13:17	24.016	11.0	2.3	105.42	479
02/09/16	13:18	24.016	11.0	2.3	106.18	479
02/09/16	13:19	24.016	10.9	2.3	106.41	478
02/09/16	13:20	24.015	10.9	2.3	105.82	477
02/09/16	13:21	24.015	10.9	2.3	105.34	476
02/09/16	13:22	24.014	10.9	2.3	105.28	476
02/09/16	13:23	24.014	10.9	2.3	105.43	477
02/09/16	13:24	24.014	10.9	2.3	105.60	478
02/09/16	13:25	24.013	11.0	2.3	105.66	477
02/09/16	13:26	24.012	10.9	2.3	105.85	477
02/09/16	13:27	24.012	10.9	2.3	105.86	478
02/09/16	13:28	24.011	11.0	2.3	106.10	479
02/09/16	13:29	24.010	11.0	2.3	106.46	481
02/09/16	13:30	24.010	10.9	2.3	106.63	481
02/09/16	13:31	24.010	10.9	2.3	106.46	481
02/09/16	13:32	24.009	10.9	2.3	106.33	481
02/09/16	13:33	24.008	10.9	2.3	106.02	478
02/09/16	13:34	24.007	10.9	2.3	105.69	478
02/09/16	13:35	24.007	10.9	2.3	105.66	478
02/09/16	13:36	24.007	10.9	2.3	105.94	477
02/09/16	13:37	24.007	11.0	2.3	106.28	476
02/09/16	13:38	24.006	10.9	2.3	106.17	476
02/09/16	13:39	24.005	10.9	2.3	106.35	476
02/09/16	13:40	24.005	10.9	2.3	106.55	479

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

U = Startup

Report Version 4.0

HTNDAHS

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/09/2016 12:11 Through 02/09/2016 14:19

Time Online Criteria: 1 minute(s)

02/09/16	13:41	24.004	11.0	2.3	106.03	479
02/09/16	13:42	24.004	10.9	2.3	105.78	480
02/09/16	13:43	24.004	10.8	2.3	106.18	479
02/09/16	13:44	24.004	10.8	2.3	106.98	478
02/09/16	13:45	24.003	10.8	2.3	107.67	479
02/09/16	13:46	24.002	10.8	2.3	106.43	477
02/09/16	13:47	24.002	10.9	2.3	106.51	475
02/09/16	13:48	24.002	10.9	2.3	106.48	475
02/09/16	13:49	24.002	10.9	2.3	106.48	475
02/09/16	13:50	24.002	10.9	2.3	106.46	475
02/09/16	13:51	24.001	10.9	2.3	105.98	476
02/09/16	13:52	24.001	11.0	2.3	105.91	476
02/09/16	13:53	24.001	11.0	2.3	106.67	476
02/09/16	13:54	24.001	11.0	2.3	107.10	478
02/09/16	13:55	24.001	11.0	2.3	106.82	480
02/09/16	13:56	24.001	11.1	2.3	106.05	480
02/09/16	13:57	24.001	11.0	2.3	105.85	480
02/09/16	13:58	24.002	11.0	2.3	106.09	480
02/09/16	13:59	24.002	11.0	2.3	106.56	479
02/09/16	14:00	24.002	11.0	2.3	106.86	478
02/09/16	14:01	24.001	11.0	2.3	107.05	478
02/09/16	14:02	24.001	11.0	2.3	106.96	478
02/09/16	14:03	24.001	10.9	2.3	106.84	477
02/09/16	14:04	24.001	10.9	2.3	106.99	477
02/09/16	14:05	24.001	11.0	2.3	106.83	477
02/09/16	14:06	24.000	10.9	2.3	107.14	477
02/09/16	14:07	23.999	10.9	2.3	106.52	477
02/09/16	14:08	23.999	11.0	2.3	106.41	477
02/09/16	14:09	23.999	11.0	2.3	106.11	479
02/09/16	14:10	23.999	11.0	2.3	105.81	481
02/09/16	14:11	23.999	11.1	2.3	105.86	482
02/09/16	14:12	23.999	11.0	2.3	106.23	482
02/09/16	14:13	23.999	11.0	2.3	106.20	481
02/09/16	14:14	23.999	11.0	2.3	106.32	479
02/09/16	14:15	23.999	11.0	2.3	106.95	478
02/09/16	14:16	23.999	11.0	2.3	107.00	477
02/09/16	14:17	23.999	11.0	2.3	106.56	476
02/09/16	14:18	23.999	10.9	2.3	106.81	477
02/09/16	14:19	23.999	10.9	2.3	106.88	476

Average	24.016	10.9	2.3	106.06	478
Minimum	23.999	10.8	2.3	103.99	473
Maximum	24.037	11.1	2.3	107.67	483
Summation	3,098.013	1,408.9	296.7	13,682.25	61,645

Included Data Points	129	129	129	129	129
Total number of Data Points	129	¹²⁹ C = Calibration	¹²⁹ S = Substituted	¹²⁹ *	¹²⁹ U = Startup

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control



Project PC16-0001.4

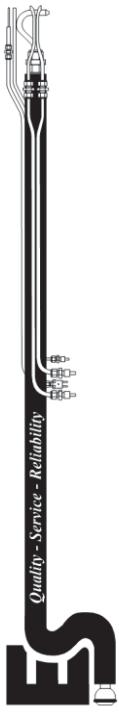
Appendix E: Calibration Information

Dry Gas Meter Pre-Test and Post-Test Calibrations

Critical Orifice Calibration Certificate

AETB Certification

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record data and information in the **GREEN** cells. **YELLOW** cells are calculated.

DATE: 7/22/2014		METER SERIAL #: 18654640		CRITICAL ORIFICE SET SERIAL #: 1531S		INITIAL BAROMETRIC PRESSURE (in Hg): 24.67		FINAL AVG (P _{bar}) 24.66										
ORIFICE #	RUN #	TESTED DGM READINGS (FT ³)				TEMPERATURES °F		ELAPSED TIME (MIN)										
		K'	TESTED VACUUM (AVG) (in Hg)	INITIAL	FINAL	AMBIENT DGM INLET	DGM OUTLET	DGM AVG	DGM ΔH (in H ₂ O)	V _n (STD)	V _{cr} (STD)	(1)	(2)	(3)	Average Y	Y % Diff to other orifices	Y % Diff with other orifices	ΔH@
23	1	0.6363	16.5	234.775	243.154	75	77	78	76	76	76.75	10.00	1.8	6.8310	6.7858	0.993	<u>1.79</u>	
	2	0.6363	16.5	243.154	251.561	8.407	75	78	78	76	76	77	10.00	1.8	6.8567	6.7858	0.991	<u>1.79</u>
	3	0.6363	16.5	251.561	260.816	9.255	75	78	79	76	77	77.5	11.00	1.8	7.5347	7.4644	0.991	<u>1.79</u>
18	1	0.5004	17.5	260.816	267.502	6.686	75	78	79	77	78	78	10.00	1.1	5.4269	5.3365	0.983	<u>1.76</u>
	2	0.5004	17.5	267.502	274.173	6.671	75	78	78	77	77	77.5	10.00	1.1	5.4197	5.3365	0.985	<u>1.77</u>
	3	0.5004	17.5	274.173	281.527	7.354	75	78	78	77	77	77.5	11.00	1.1	5.9746	5.8702	0.983	<u>1.77</u>
16	1	0.4381	18	281.527	287.454	5.927	75	78	79	77	78	78	10.00	0.87	4.8075	4.6721	0.972	<u>1.82</u>
	2	0.4381	18	287.454	293.340	5.886	75	79	80	78	79	79	10.00	0.87	4.7654	4.6721	0.980	<u>1.82</u>
	3	0.4381	18	293.340	299.310	5.970	75	79	80	78	79	79	10.00	0.87	4.8334	4.6721	0.967	<u>1.82</u>

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_n (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

$$(1) \quad Vm_{(std)} = K_1 * Vm * \frac{Pbar * \Theta}{Tm} \quad = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$$(2) \quad Vcr_{(std)} = K_* \frac{Pbar * \Theta}{\sqrt{Tamb}} \quad = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$Y = \frac{Vcr_{(std)}}{Vm_{(std)}} \quad = \text{DGM calibration factor}$$

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y =

$$\text{AVERAGE } \Delta H@ = \frac{0.9827}{1.79}$$

$$\Delta H@ = \left(\frac{0.75 \cdot \theta}{V_{cr}(\text{std})} \right)^2 \Delta H \left(\frac{V_m(\text{std})}{V_n} \right)$$

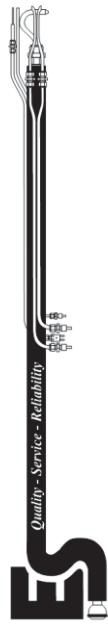
$K_1 = 17.64^{\circ}\text{R}$ in. Hg (English), 0.3838 °K mm Hg (Metric)

$T_m = \text{Absolute DGM avg. temperature } (^{\circ}\text{R} - \text{English}, ^{\circ}\text{K} - \text{Metric})$

$T_{amb} = \text{Absolute ambient temperature } (^{\circ}\text{R English, } ^{\circ}\text{K Metric})$

$K^* = \text{Average K' factor from Critical Orifice Calibration}$

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



EMCO

EMISSIONS MEASUREMENT COMPANY

ENVIRONMENTAL SUPPLY COMPANY

DATE:	2/9/2016	METER SERIAL #:	18654640
METER ID #:	MS-2	CRITICAL ORIFICE SET SERIAL #:	1531's

ORIFICE #	RUN #	K [*]	TESTED VACUUM (in Hg)	DGM READINGS (ft ³)	AMBIENT INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _{cr} (STD)	(2) V _{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	ΔH _®	
18	1	0.4976	17	833.275	836.445	3.170	53	55	54	54.5	5.00	1.1	2.6623	2.6811	1.007	1.81	
	2	0.4976	17	836.584	839.821	3.237	53	55	55	55	5.00	1.1	2.7160	2.6811	0.987	1.81	
	3	0.4976	17	839.821	843.036	3.215	53	55	54	55	54.75	5.00	1.1	2.6888	2.6811	0.993	1.81
23	1	0.6366	16	848.777	852.864	4.087	53	56	56	56	55.75	5.00	1.8	3.4313	3.450	1.000	1.81
	2	0.6366	16	852.864	856.919	4.085	53	54	54	55	54.5	5.00	1.8	3.4128	3.450	1.005	1.81
	3	0.4449	18	843.036	845.925	2.889	53	55	55	55	55	5.00	0.88	2.4224	2.3971	0.990	1.81
16	1	0.4449	18	845.925	848.777	2.852	53	55	56	55	55.25	5.00	0.88	2.3902	2.3971	1.003	1.80
	2	0.4449	18										Avg =	0.996	-0.19	0.04	

INITIAL BAROMETRIC PRESSURE (in Hg): **24.3** # **24.5** **24.4**

ORIFICE #	RUN #	K [*]	TESTED VACUUM (in Hg)	DGM READINGS (ft ³)	AMBIENT INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _{cr} (STD)	(2) V _{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	ΔH _®	
18	1	0.4976	17	833.275	836.445	3.170	53	55	54	54.5	5.00	1.1	2.6623	2.6811	1.007	1.81	
	2	0.4976	17	836.584	839.821	3.237	53	55	55	55	5.00	1.1	2.7160	2.6811	0.987	1.81	
	3	0.4976	17	839.821	843.036	3.215	53	55	54	55	54.75	5.00	1.1	2.6888	2.6811	0.993	1.81
23	1	0.6366	16	848.777	852.864	4.087	53	56	56	56	55.75	5.00	1.8	3.4313	3.450	1.000	1.81
	2	0.6366	16	852.864	856.919	4.085	53	54	54	55	54.5	5.00	1.8	3.4128	3.450	1.005	1.81
	3	0.4449	18	843.036	845.925	2.889	53	55	55	55	55	5.00	0.88	2.4224	2.3971	0.990	1.81
16	1	0.4449	18	845.925	848.777	2.852	53	55	56	55	55.25	5.00	0.88	2.3902	2.3971	1.003	1.80
	2	0.4449	18										Avg =	0.996	-0.19	0.04	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_{cr} (std), and the critical orifice, V_o (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.9982**

INITIAL DRY GAS METER CALIBRATION FACTOR, Y = **0.9827**

$$\Delta H_{\circ} = \left(\frac{0.75 \theta}{V_{cr}(\text{std})} \right)^2 \Delta H \left(\frac{V_m(\text{std})}{V_m} \right)$$

% DIFFERENCE = **1.57%** (Must be <5%)

AVERAGE ΔH_® = **1.81**

$$(1) \quad Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions

$$(2) \quad Vcr_{(std)} = K^* * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions

$$(3) \quad Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

40 CFR Part 60, Appendix A-1 Method 2 §10.3: Temperature Sensors. After each field use, calibrate thermocouples at a temperature within 10% of the average absolute stack temperature. A reference thermocouple and potentiometer (calibrated against NIST standards) may be used. The absolute temperature measured with the sensor being calibrated and the reference sensor must agree within 1.5%.

Thermocouple Calibration using NIST Traceable PIE Model 520 Calibrator

Reference Value: **250**

Console Value: **251**

Percent Difference: **0.4%**

Acceptance Criteria: ±1.5%

Pre-calibration Procedure

- Check max vacuum (21-22 1/2 "Hg), leak check. Use WD-40 if necessary.
- Check pump oil fill level and pump knockout. Make sure there is extra pump oil.
- Check gauge oil on manometer. Add oil if necessary. Check for spare oil in back of meter.
- Wipe interior and exterior of meter clean with wet rag/soap.
- Check for missing or loose screws on meter box, pump housing and manometer.
- Proceed to meter and thermocouple calibration.
- Initial here upon completion **ws**

Model Number **520-K**
Serial No. **S/N 107078**
Calibration Date **02-03-09**
In Service Date _____
Calibration Due _____

PIE Practical Instrument Electronics
Tel: (860) 872-2000 • Fax: (860) 872-2638

CERTIFICATE OF CALIBRATION

This is to certify that your instrument has been calibrated using standards whose

accuracy are traceable to the National Institute of Standards and Technology

(Formerly NBS) within the terms of NIST Calibration Services. Actual records

pertaining to these standards are on file and are available for examination.

Certified by: Practical Instrument Electronics

Recommended Recalibration: Annually

METHOD 5 CRITICAL ORIFICE CALIBRATION



CRITICAL ORIFICE SET S/N: 1531s

DATE: January 8, 2016

REFERENCE DRY GAS METER
SERIAL NUMBER: 16300942
CALIBRATION FACTOR, Yc: 0.991

LEAK CHECK: Passed

ORIFICE # / RUN #	CRITICAL VACUUM (in Hg)	TESTED VACUUM (in Hg)	Barometric Pressure per Orifice AVG (Pa _{bar})	DGM READINGS (FT)				DGM OUTLET TEMP °F	DGM TIME (MIN)	DGM AH (in H ₂ O)	K' FACTOR (english)	K' FACTOR (metric-liters)	K' FACTOR VARIATION (%)	
				INITIAL	FINAL	NET (V _d)	AMBIENT							
31	1	15	17.5	67.132	73.855	6.723	70.9	74.3	74.3	74.35	6.00	4.12	-0.04	
	2	15	17.5	73.855	80.552	6.727	70.9	74.3	74.1	74.3	74.25	4.12	0.04	
23	1	15	18	80.582	86.457	5.875	71.0	74.2	74.0	74.3	74.20	7.00	2.29	0.01
	2	15	18	86.457	92.331	5.874	70.9	74.0	73.9	74.3	74.13	7.00	2.29	-0.01
18	1	15	18	92.331	97.558	5.257	71.0	74.1	74.1	74.4	74.25	8.00	1.44	0.05
	2	15	18	97.558	102.850	5.262	70.9	74.0	74.0	74.4	74.20	8.00	1.44	0.05
16	1	15	18	102.850	108.733	5.883	71.1	74.1	74.1	74.5	74.30	10.00	1.15	0.03
	2	15	18	108.733	114.613	5.880	71.1	74.1	74.1	74.5	74.30	10.00	1.15	-0.03
12	1	15	18	114.613	119.720	5.107	71.1	74.0	73.8	74.5	74.20	12.00	0.58	0.06
	2	15	18	119.720	124.833	5.113	71.1	73.8	74.1	74.5	74.20	12.00	0.58	0.06

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations in US EPA Method 5, Section 7.2.3 (these equations are programmed on the spreadsheet included with each orifice set).

K' = Critical orifice coefficient,

Critical Orifice Set number 1531s was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, Section 7.2.

[(ft³)°R]^{1/2}]/[(in.Hg)(min.)] - English Units
[(liters)(°K)^{1/2}]/[(mm Hg)(min.)] - Metric-Liters Units
[(m³)°K]^{1/2}]/[(mm Hg)(min.)] - Metric Units

John B. L.
Signature
Date

RE: Certification of Air Emission Testing Body (AETB) Conformance

To Whom it May Concern:

This letter is to confirm that Emissions Measurement Company LLC ("EMCo") is an Air Emission Testing Body (AETB) operating in conformance with ASTM D7036-04, as required by 40 CFR Part 75, Appendix A §6.1.2. The table below lists the EPA Reference Methods for which each listed Project Manager is a Qualified Individual and other relevant information required by (as applicable) 40 CFR Part 75.59(a)(15), 40 CFR Part 75.59(b)(6) and 40 CFR Part 75.59(d)(4).

Emissions Measurement Company (800) 984-9883					
AETB Qualified Individual Information					
QI Name	QI Email	Exam*	Exam Date	Exam Provider	Provider Email
Andrew Bruning	abruning@stacktest.us	SES Group 1	6/12/2014	SES	QSTIprogram@gmail.com
		SES Group 2	9/18/2015		
Mike Corrigan	mcorrigan@stacktest.us	SES Group 3	6/12/2015	Ohio-Lumex	andrew.mertz@ohiolumex.com
		EPA Method 30B	1/16/2015*		
Craig Kormylo	ckormylo@stacktest.us	SES Group 1	4/1/2015	SES	QSTIprogram@gmail.com
Matthew Parks	mparks@stacktest.us	SES Group 3	5/12/2011	Ohio-Lumex	andrew.mertz@ohiolumex.com
		EPA Method 30B	1/16/2015*		
*The Source Evaluation Society (SES) Group 1 Exam includes EPA Reference Methods 1, 1A, 2, 2A, 2C, 2D, 2F, 2G, 2H, 3, 3B, 4, 5, 5A, 5B, 5D, 5E, 5F, 5I, 17, 19, 201A and 202. The SES Group 2 Exam includes EPA Reference Methods 1, 2, 3, 4, 3B, 6, 6A, 6B, 7, 7C, 7D, 8, 11, 13A, 13B, 15A, 16A, 19, 26, 26A and 202. The SES Group 3 Exam includes EPA Reference Methods 3A, 6C, 7E, 10, 10B, 20, 25A, 40 CFR Part 60 Performance Specifications 2 – 8, 15 and <u>40 CFR Part 75</u> . Initial 30B training provided by Ohio-Lumex; refresher exam administered by EMCo once every five years.					

Please feel free to contact me with any questions regarding the above.



Matthew Parks
Technical Director